

02/12/98  
1547 U.S. PAT. & TM. OFF. 1000

## PATENT APPLICATION TRANSMITTAL LETTER

Assistant Commissioner of Patents  
Washington, D.C. 20231

Transmitted herewith for filing in the patent application of:

Richard G. HenryFor: Zero Volatile Organic Compound Compositions Based Upon Organic Solvents which are Negligibly Reactive with Hydroxyl Radical and do not Contribute Appreciably to the Formation of Ground Based Ozone

Enclosed are:

- [ ] \_\_\_\_\_ sheets of drawing(s).  
[ ] an assignment of an invention to \_\_\_\_\_ application.  
[ ] a certified copy of a \_\_\_\_\_ application.  
[ ] associate power of attorney.  
[xx] a small entity statement was previously filed with the Patent and Trademark Office in connection with the priority provisional application serial no. 60/053,073.

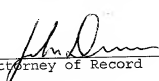
## CLAIMS AS FILED

FOR	NO. FILED	NO. EXTRA	RATE	FEE
TOTAL CLAIMS	26 - 20 =	6	[ ] \$22 LARGE [xx] \$11 SMALL	\$ 66.00
INDEPENDENT CLAIMS	4 - 3 =	1	[ ] \$80 LARGE [xx] \$41 SMALL	\$ 41.00
BASIC FEE	[ ] LARGE ENTITY	\$790	[xx] SMALL ENTITY	\$395
TOTAL FILING FEE				\$ 502.00

☐ Please charge Deposit Account No. 06-0308 in the amount of \$\_\_\_\_\_.  
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any additional fees which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment to Deposit Account No. 06-0308. A duplicate copy of this sheet is enclosed.

☒ A check in the amount of \$ 502.00 to cover the filing fee is enclosed.

2/12/98  
Date  
Attorney of RecordA. John Demarco  
Reg. No. 40,586FAY, SHARPE, BEALL, FAGAN,  
MINNICH & MCKEE  
1100 Superior Avenue  
Suite 700  
Cleveland, Ohio 44114-2518  
(216) 861-5582"Express Mail" Mailing Label Number EM098335726USDate of Deposit February 12, 1998

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Ben Trella

(PRINTED OR STAMPED NAME OF SENDER)

(PRINTED NAME OF SENDER)

Direct all telephone calls to: Timothy E. Nauman, Esq.  
at telephone number: (216) 861-5582.

Address all correspondence to:

Timothy E. Nauman, Esq.  
FAY, SHARPE, BEALL, FAGAN, MINNICH & McKEE  
1100 Superior Avenue - Suite 700  
Cleveland, Ohio 44114-2518

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole inventor: Richard G. Henry

Inventor's signature

Date:

Residence: 26945 Amhearst Circle  
Beachwood, OH 44122

Citizenship: U.S.A.

Post Office Address: 498 South Belvoir Boulevard  
Euclid, OH 44121

"Express Mail" Mailing Label Number EM098335  
Date of Deposit February 12, 1998  
I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Ben Trella  
(TYPED OR PRINTED NAME OF SENDER)  
[Signature]  
(SIGNATURE)

- 1 -

ACD 2 016

ZERO VOLATILE ORGANIC COMPOUND COMPOSITIONS BASED UPON  
ORGANIC SOLVENTS WHICH ARE NEGLIGIBLY REACTIVE WITH  
HYDROXYL RADICAL AND DO NOT CONTRIBUTE APPRECIABLY TO  
THE FORMATION OF GROUND BASED OZONE

Cross-Noting to Related Applications

This application claims the benefit of U.S.  
Provisional Application No. 60/053,073, filed July 18,  
1997.

Background of the Invention

5 This invention pertains to the art of solvent  
blends and solvent/resin blends. More, particularly this  
invention pertains to blends that do not contribute to the  
formation of ground based ozone or smog. The invention is  
particularly applicable to solvent blends and  
10 solvent/resin blends that have no volatile organic  
compounds for use with adhesives, coatings, inks, cleaning  
and blowing agents and the like and will be described with  
particular reference thereto. However, it will be  
appreciated that the invention may be advantageously  
15 employed in other environments and applications.

Heretofore, hydrocarbon-based solvents have been  
used to dissolve organic materials in many industrial  
applications. However, recently, hydrocarbon-based  
solvents have fallen out of favor because they have been  
20 classified by the United States Environmental Protection  
Agency and other international regulatory bodies as  
materials that contribute to the formation of ground based  
ozone or smog. This has created a need for other types of  
solvents for the production of coatings, adhesives, inks  
25 and the like.

Upon evaporation, a highly-reactive,  
hydrocarbon-based solvent reacts with hydroxyl radicals  
and ultraviolet light very close to the ground to form a  
photochemical smog that is considered harmful and in some

0002779-001208

cases dangerous. Some cities have severe smog which reduces visibility and actually causes "ozone alerts". In part, the smog is caused by hydrocarbon emissions from cars. However, another major contributor is industrial use of hydrocarbon-based solvents such as hexane and toluene.

The benchmark for desired reaction rates of hydrocarbon-based compounds is ethane. If a compound has a reaction rate with the hydroxyl radical and ultraviolet ("UV") light that is faster than ethane, the compound reacts too close to the ground and consequently generates ozone and smog. Such compounds are defined as volatile organic compounds (VOCs). On the other hand, if a compound has a reaction rate that is slower than ethane, the compound reaches higher into the atmosphere before reacting with the hydroxyl radical and UV light. In such instances the non-VOC compound does not contribute to the formation of ground based ozone and smog.

Some of the more reactive VOCs are:

toluene;  
methyl ethyl ketone;  
diacetone alcohol;  
hexane;  
isopropyl alcohol;  
pentane;  
dibasic esters;  
trichloroethylene;  
benzene;  
ethyl acetate;  
butyl acetate;  
n-methyl pyrrolidone;  
glycol ethers;  
d-limonene;  
terpene hydrocarbon solvents;  
dimethyl ether; and,  
tetrahydrofuran.

09062779.021208



Another object of the present invention are solvents and solvent/resin blends that are safer to the environment than even water-based systems which still must contain a volatile organic solvent to aid in film formation.

Yet another object of the present invention are environmentally-safer solvent compositions which do not contribute to the formation of ground based ozone which will be useful in the formulation of cleaning agents, coatings, adhesives, inks and also blowing agents for the production of plastic foams.

### Summary of the Invention

The present invention contemplates new and improved solvent and solvent-resin compositions which overcome all of the above referenced problems and others and which are economical and effective for their intended uses.

In accordance with the present invention, there is provided a solvent-resin composition having generally zero volatile organic compounds (VOCs). The composition consists essentially of a resin component and a solvent component. The solvent component is 5-95% by total volume of the solvent-resin composition and is one or more of the zero-VOC solvents selected from the group consisting of:

chlorobromomethane;  
1-bromopropane;  
n-alkane (C12-C18);  
t-butyl acetate;  
perchloroethylene;  
benzotrifluoride;  
parachlorobenzotrifluoride;  
acetone;  
1,2-dichloro-1,1,2-trifluoroethane;  
dimethoxymethane;

1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-  
butane;

2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-  
heptafluoropropane;

5 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane; and,

2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-  
heptafluoropropane.

10 In accordance with a more limited aspect of the invention, the solvent component is present in the amount 40-95% by total volume of the composition.

In accordance with a still more limited aspect of the invention, the solvent component is present in the amount 30%-80% by total volume of the composition.

15 A principal advantage of the invention is that it is environmentally safer yet still capable of effectively dissolving resins.

20 Another advantage of the invention is that it may be used in place of solvents currently used for inks, adhesives, coatings and the like.

Still other advantages and benefits of the invention will become apparent to those skilled in the art upon a reading and understanding of the following detailed description.

#### 25 Detailed Description of the Preferred Embodiments

The compositions of the present invention are high-performance solvent and solvent-resin blends that are generally free of VOCs. The compositions as herein described and as set forth in the claims are expressed in terms of percentages by volume unless clearly indicated to the contrary.

30 In describing the compositions of the present invention, reference will be made to certain resin classifications which require a totally VOC-free solvent system to be environmentally safe. These resin classifications are:

09022779.021298

- 5 a) acrylic-thermoplastic;  
b) acrylic-thermosetting;  
c) chlorinated rubber;  
d) epoxy (either one or two part);  
e) hydrocarbon (e.g., olefins, terpene  
resins, rosin esters, coumarone-  
indene, styrene-butadiene, styrene,  
methyl-styrene, vinyl-toluene,  
nitrocellulose, polychloroprene,  
10 polyamide, polyvinyl chloride and  
isobutylene);  
f) phenolic;  
g) polyester and alkyd;  
h) polyurethane;  
15 i) silicone;  
j) urea; and,  
k) vinyl and vinyl acetate.

20 It is to be appreciated that this list does not include  
all resin classifications. Other resin classifications  
are intended to be encompassed by the scope of the present  
invention.

Effective solvents of the present invention  
which have reaction rates with hydroxyl ion slower than  
ethane are:

- 25 1) chlorobromomethane;  
2) 1-bromopropane;  
3) methyl acetate;  
4) n-alkane (C12-C18);  
5) t-butyl acetate;  
30 6) perchloroethylene;  
7) benzotrifluoride;  
8) parachlorobenzotrifluoride  
9) acetone;  
10) 1,2-dichloro-1,1,2-trifluoroethane  
35 11) dimethoxymethane;



- 12) 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane;
- 13) 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane;
- 14) 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane;
- 15) 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane;
- 16) methylene chloride; and,
- 17) technical white oils (mineral oils).

It is to be appreciated that this list does not include all effective non-VOC solvents. Other effective non-VOC solvents are intended to be encompassed by the scope of the present invention.

The type of specific applications (hence the denotation "a" alongside the number identifying the application) for which the solvents and solvent-resin blends of the present invention may be used are as follows:

- 1a) adhesives
- 2a) blowing agents
- 3a) coatings
- 4a) cleaning compositions
- 5a) inks

The zero-VOC solvent and solvent-resin blends of the present invention as well as their applications are set forth in the table below. The table uses the identifiers set out above, i.e., a numeral alone for the solvent and a numeral followed by "a" for the application.

SOLVENT AND SOLVENT-RESIN COMPOSITIONS HAVING ZERO VOCs

10

	1,2-dichloro- 1,1,2- trifluoroethane	1-9, 11-16	a, k	1a-5a
	dimethoxymethane	1-3,7-10, 12-16	a	1a-5a
5	1,1,1,2,2,3,3,4,4- nonafluoro-4- methoxy-butane	1-11, 13,15	a	2a, 4a
10	2- (difluoromethoxyme thyl)- 1,1,1,2,3,3,3- heptafluoropropane	1-12, 14,15	a	2a, 4a
15	1-ethoxy- 1,1,2,2,3,3,4,4,4- nonafluorobutane	1-13, 15	a	2a,4a
20	2- (ethoxydifluoromet hyl)- 1,1,1,2,3,3,3- heptafluoropropane	1-4	a	2a,4a
	methylene chloride	2-15	a-k	1a-5a
	technical white oils (mineral)	1-16	a,e,g	5a

25 A better understanding of the present invention  
can be had by reference to the following descriptions of  
embodiments which effectively meet the objectives outlined  
above.

30 One preferred embodiment includes mixing one or  
more of the polymeric resins:  
acrylic-thermoplastic;  
acrylic-thermosetting;  
chlorinated rubber;  
epoxy resin;

hydrocarbon (e.g., olefins, terpene resins, rosin esters, coumarone-indene, styrene-butadiene, styrene, methyl-styrene, vinyl-toluene, nitrocellulose, polychloroprene, polyamide, polyvinyl chloride and isobutylene);  
phenolic;  
polyester and/or alkyd;  
polyurethane;  
silicone;  
urea; and/or  
vinyl or vinyl acetate,

with 10-90%, by total volume of the composition, of one or more of non-VOC solvents such as:

chlorobromomethane;  
1-bromopropane;  
methyl acetate;  
n-alkane (C12-C18);  
t-butyl acetate;  
perchloroethylene;  
benzotrifluoride;  
parachlorobenzotrifluoride;  
acetone;  
1,2-dichloro-1,1,2-trifluoroethane;  
dimethoxymethane; and/or  
methylene chloride.

The individual solvents or blends thereof are added until all of the resin(s) is dissolved.

In an embodiment for coatings and/or adhesives, the mixture preferably has a high resin content, i.e., a resin content of 20%-60% by volume. In another embodiment for inks, the mixture preferably contains a lower concentration of the resin, i.e., 5%-30% by volume. In yet another embodiment, various pigments or additives are added to achieve a desired range of properties.

In another preferred embodiment of the present invention, 5-90% methyl acetate, by total volume of the

composition, is added to 10-95% of a solvent or solvent blend selected from the group:

- chlorobromomethane;
- 1-bromopropane;
- 5 n-alkane (C12-C18);
- t-butyl Acetate;
- perchloroethylene;
- benzotrifluoride;
- parachlorobenzotrifluoride;
- 10 acetone;
- 1,2-dichloro-1,1,2-trifluoroethane;
- dimethoxymethane;
- 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-
- butane;
- 15 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane;
- 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane; and,
- 20 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane.

These formulations are used as a cleaning composition for the removal of hydrocarbon or ionic contaminants from circuit boards or in the formulation of coatings, inks, or adhesives. Of course, the formulations may be used for other applications as well.

The following enumerated embodiments have the ability to dissolve resins for the production of coatings, adhesives, and inks as well. In addition, the embodiments are equally useful as cleaning formulations. The ranges for the embodiments are expressed in % by volume of the total solvent-resin composition or, alternatively, the total solvent composition of an initially non-resin containing solvent, such as a cleaning composition. The embodiments are:

- (1) 10-90% benzotrifluoride and 10-90% of one or more of the solvents:

- (a) 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane;
- (b) 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane;
- 5 (c) 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane;
- (d) 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane;
- (e) perchloroethylene;
- 10 (f) 1-bromopropane;
- (g) acetone;
- (h) n-alkane (C12-C16);
- (i) t-butyl acetate (C12-C16); and,
- (j) parachlorobenzotrifluoride;
- 15 (2) 5-20% benzotrifluoride and 80-95% 1-bromopropane;
- (3) 10-90% acetone and 10-90% n-alkane(C12-C18);
- (4) 10-90% 1-bromopropane and 10-90% of one or more of:
- 20 (a) chlorobromomethane; and,
- (b) n-alkane (C12-C18);
- (5) 10-90% parachlorobenzotrifluoride and 10-90% of one or more of:
- (a) 1-bromopropane;
- 25 (b) chlorobromomethane;
- (c) t-butyl acetate; and,
- (d) n-alkane (C12-C18);
- (6) 10-90% 1,2-dichloro-1,1,1-trifluoroethane and 10-90% of one or more of:
- 30 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane;
- 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane;
- 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane;
- and,
- 35 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane;
- 1-bromopropane

09022779,024298

acetone;  
benzotrifluoride; and,  
methyl acetate.

5 Analogously, the following VOC-free embodiment has the ability to dissolve resins for the production of coatings, adhesives, and inks as well. In addition, the embodiment is equally useful in cleaning formulations:

10 10-90% methylene chloride and 10-90% of one or more of the following solvents:  
chlorobromomethane;  
1-bromopropane;  
methyl acetate;  
n-alkane (C12-C18);  
15 t-butyl acetate;  
perchloroethylene;  
benzotrifluoride;  
parachlorobenzotrifluoride;  
acetone;  
20 1,2-dichloro-1,1,2-trifluoroethane; and,  
dimethoxymethane.

An added benefit to mixing methylene chloride with other solvents is the reduction in the overall toxicity of methylene chloride.

25 Other preferred solvent-resin compositions include VOC-free solvents which have the ability to dissolve resins for the production of coatings, adhesives, and inks. The compositions include any of the above-listed resins and the following solvent mixtures, which are expressed in terms of % by volume of the solvent-resin  
30 composition:

- (1) 1-20% technical white oil and 10-90% n-alkane (C12-C18);
- (2) 1-20% technical white oil and 10-90% methyl acetate;
- 35 (3) 1-20% technical white oil and 10-90% t-butyl acetate;

09022779.021233

(4) 1-20% technical white oil and 10-90% benzotrifluoride;

(5) 1-20% technical white oil and 10-90% acetone;

5 (6) 1-20% technical white oil and 10-90% parachlorobenzotrifluoride;

(7) 1-20% technical white oil and 10-90% parachlorobenzotrifluoride;

(8) 1-20% technical white oil and 10-90% perchloroethylene;

10 (9) 1-20% technical white oil and 10-90% methylene chloride; and,

(10) 1-20% technical white oil and 10-90% of a mixture of methylene chloride, acetone, t-butyl acetate, methyl acetate and perchloroethylene.

15 The following VOC-free embodiment, expressed in terms of % by volume of total composition, is useful as an environmentally-safer blowing agent composition for the production of polyurethane or isocyanurate foams:

20 99-99.98% 1,2-dichloro-1,1,1-trifluoroethane and 0.01-0.5% alpha-methyl styrene to inhibit polymerization. In addition this embodiment has the ability to dissolve resins for the production of coatings, adhesives, and inks, and is useful in cleaning formulations.

25 Another embodiment useful as an environmentally-safer blowing agent composition is:

100 parts by weight polyether triol;

50 parts by weight toluene diisocyanate or toluene diisocyanurate;

30 2 parts by weight water;

0.15 parts catalyst;

0.5-2 parts surfactant; and,

4-10 parts 1-bromopropane or chlorobromomethane.

35 Still another embodiment useful as an environmentally-safer blowing agent composition, in terms of percent by weight of the total composition (including catalyst and surfactant), is:

00000000.021298



5

0-5% catalyst;

2-15% 1-bromopropane or chlorobromomethane. The appropriate catalysts and surfactants are selected from those known in the art.

10

15

1-2% water;

0.3-1.5% surfactant; and,

20

2.4-6.1% 1-bromopropane or chlorobromomethane.

This composition is useful for the manufacture of a flexible furniture grade foam with a density of 0.024 g/cm<sup>3</sup>. blowing agent.

25

30

35

polyvinyl chloride polymer, acrylic, epoxy, urethane, nitrocellulose, or styrene.

Another zero-VOC adhesive starts with 100 grams of 1-bromopropane and/or benzotrifluoride. Then, 10-100 grams of styrene-butadiene, polychloroprene, polyvinyl chloride, acrylic, epoxy, urethane, nitrocellulose, or styrene polymer or resin is added. This also produces a contact adhesive with excellent bond strength. It is appreciated that other additives may be used to improve wetting and defoaming although they are not always required. Another preferred embodiment of this mixture contains approximately 40-95%, by volume, of 1-bromopropane and/or benzotrifluoride, and 5-60% of styrene-butadiene, polychloroprene, polyvinyl chloride, acrylic, epoxy, urethane, nitrocellulose, or styrene polymer or resin. Still another preferred embodiment of this mixture contains approximately 70-95%, by volume, of 1-bromopropane and/or benzotrifluoride, and 5-30% of styrene-butadiene, polychloroprene, polyvinyl chloride, acrylic, epoxy, urethane, nitrocellulose, or styrene polymer or resin.

Still another embodiment of a zero-VOC adhesive starts with 350g 1-bromopropane and/or benzotrifluoride. Then, 20-100 grams of styrene butadiene rubber is added. Optionally, 5-10%, by volume, acetone is added to improve solubility if necessary. Another preferred embodiment of this mixture contains approximately 50-90%, by volume, of 1-bromopropane, and 10-30% of acrylic polymer or urethane polymer. Optionally, 5-10%, by volume, acetone is added to improve solubility if necessary.

The following VOC-free embodiment has the ability to dissolve resins for the production of coatings, adhesives, and inks as well. Further, the solvent includes stabilizers to stabilize against attack on aluminum. In addition, the embodiment is useful in cleaning formulations:

70-90%, by volume, 1,2-dichloro-1,1,1-trifluoroethane;

9-29% dimethoxymethane; and

5 0.5% butylene oxide and 0.5% nitromethane to stabilize against attack on aluminum. Optionally, 5-10%, by volume, acetone is added to the total composition to improve solubility if necessary.

10 All of the embodiments of the present invention may interchangeably use any of the other non-VOC solvents listed above.

The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon a reading and understanding of this specification. It is intended to include all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

0002770 000000

Having thus described the invention, it is claimed:

5 1. A solvent-resin composition having generally zero volatile organic compounds (VOCs), the composition consisting essentially of a resin component and a solvent component, the solvent component being 5-95% by total volume of the solvent-resin composition, the solvent component being one or more of the zero-VOC solvents  
10 selected from the group consisting of:

- 1) chlorobromomethane;
- 2) 1-bromopropane;
- 3) methyl acetate;
- 4) n-alkane (C12-C18);
- 15 5) t-butyl acetate;
- 6) perchloroethylene;
- 7) benzotrifluoride;
- 8) parachlorobenzotrifluoride
- 9) acetone;
- 20 10) 1,2-dichloro-1,1,2-trifluoroethane
- 11) dimethoxymethane;
- 12) 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane;
- 13) 2-(difluoromethoxymethyl)-
- 25 1,1,1,2,3,3,3-heptafluoropropane;
- 14) 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane;
- 15) 2-(ethoxydifluoromethyl)-
- 1,1,1,2,3,3,3-heptafluoropropane;
- 30 16) methylene chloride; and,
- 17) technical white oils (mineral oils).

2. The composition according to claim 1 wherein the solvent component is present in the amount 40-95% by total volume of the composition.

0002779-021308

3. The composition according to claim 2 for use as an adhesive wherein the solvent component is present in the amount 30%-80% by total volume of the composition.

4. The composition according to claim 2 for use as an ink wherein the solvent component is present in the amount 70%-95% by total volume of the composition.

5. The composition according to claim 1 wherein the solvent component is present in the amount 10-90%, by total volume of the composition, and a portion of the solvent component is selected from the group consisting of:

chlorobromomethane;  
1-bromopropane;  
methyl acetate;  
n-alkane (C12-C18);  
t-butyl acetate;  
perchloroethylene;  
benzotrifluoride;  
parachlorobenzotrifluoride;  
acetone;  
1,2-dichloro-1,1,2-trifluoroethane;  
dimethoxymethane; and/or  
methylene chloride.

6. The composition according to claim 1 wherein the resin component includes methyl acetate, wherein the solvent component is present in the amount 10-95% by total volume, and wherein at least a portion of the solvent component is selected from the group consisting of:

chlorobromomethane;  
1-bromopropane;  
n-alkane (C12-C18);  
t-butyl acetate;  
perchloroethylene;

benzotrifluoride;  
parachlorobenzotrifluoride;  
acetone;  
1,2-dichloro-1,1,2-trifluoroethane;  
15 dimethoxymethane;  
1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-  
butane;  
2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-  
heptafluoropropane;  
20 1-ethoxy-1,1,2,2,3,3,4,4,4-  
nonafluorobutane; and,  
2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-  
heptafluoropropane.

7. The composition according to claim 1 wherein at  
least a portion of the solvent component, expressed in  
terms of % by total volume of the at least a portion of  
the solvent component, is selected from the group  
5 consisting of:

- (1) 10-90% benzotrifluoride and 10-90% of one or  
more of the solvents:  
(a) 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-  
butane;  
10 (b) 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-  
heptafluoropropane;  
(c) 1-ethoxy-1,1,2,2,3,3,4,4,4-  
nonafluorobutane;  
(d) 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-  
15 heptafluoropropane;  
(e) perchloroethylene;  
(f) 1-bromopropane;  
(g) acetone;  
(h) n-alkane (C12-C16);  
20 (i) t-butyl acetate (C12-C16); and,  
(j) parachlorobenzotrifluoride;

- 25 (2) 5-20% benzotrifluoride and 80-95% 1-bromopropane;  
(3) 10-90% acetone and 10-90% n-alkane (C12-C18);  
(4) 10-90% 1-bromopropane and 10-90% of one or more  
of:  
(a) chlorobromomethane; and,  
(b) n-alkane (C12-C18);  
30 (5) 10-90% parachlorobenzotrifluoride and 10-90% of  
one or more of:  
(a) 1-bromopropane;  
(b) chlorobromomethane;  
(c) t-butyl acetate; and,  
(d) n-alkane (C12-C18);  
35 (6) 10-90% 1,2-dichloro-1,1,1-trifluoroethane and  
10-90% of one or more of:  
1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane;  
2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-  
heptafluoropropane;  
40 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane;  
and,  
2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-  
heptafluoropropane;  
1-bromopropane  
45 acetone;  
benzotrifluoride; and,  
methyl acetate.

8. The composition according to claim 1 wherein the  
solvent component consists essentially of 10-90% methylene  
chloride and 10-90% of one or more of the solvents  
selected from the group consisting of:  
5 chlorobromomethane;  
1-bromopropane;  
methyl acetate;  
n-alkane (C12-C18);  
t-butyl acetate;





1-bromopropane, and 10-30% of one or more of resins selected from the group of acrylic polymer and urethane polymer.

14. The composition according to claim 1 further consisting essentially of approximately 45-85%, by volume, of 1-bromopropane, and 10-30% of acrylic polymer or urethane polymer, and 5-10%, by volume, acetone to improve  
5 solubility if necessary.

15. The composition according to claim 1 further consisting essentially of approximately 40-90%, by total volume of the composition, of 1-bromopropane, approximately 5-35% of a hydrocarbon resin, and  
5 approximately 5-25% of a resin, at least a portion of the resin being selected from the group of styrene-butadiene, polychloroprene, polyvinyl chloride, acrylic, epoxy, urethane, nitrocellulose, or styrene.

16. The composition according to claim 1 wherein the a portion of the hydrocarbon resin is selected from the group of olefin, rosin ester and terpene.

17. The composition according to claim 1 further consisting essentially of approximately:

70-90%, by volume, 1,2-dichloro-1,1,1-trifluoroethane;  
5 9-29% dimethoxymethane; and,  
0.5% butylene oxide and 0.5% nitromethane to stabilize the composition.

18. The composition according to claim 17 wherein approximately 5-10% by volume acetone is added to the composition to improve solubility as necessary.

19. The composition according to claim 1 wherein the solvent component, expressed in terms of % by total volume of the composition, consists essentially of 1-20% technical white oil and 10-90% of one or more solvents selected from the group consisting of:

- (1) n-alkane (C12-C18);
- (2) methyl acetate;
- (3) t-butyl acetate;
- (4) benzotrifluoride;
- (5) acetone;
- (6) parachlorobenzotrifluoride;
- (7) parachlorobenzotrifluoride;
- (8) perchloroethylene; and,
- (9) methylene chloride; and,
- (10) a mixture of methylene chloride, acetone, t-butyl acetate, methyl acetate and perchloroethylene

20. The composition according to claim 19 wherein the solvent component, expressed in terms of % by total volume of the composition, consists essentially of 1-20% technical white oil and 10-90% of one or more of: methylene chloride; acetone; t-butyl acetate; methyl acetate; and, perchloroethylene

21. A resin-solvent composition for use as an adhesive comprising approximately:

- 40-90%, by total volume of the composition, of one or more of 1-bromopropane and benzotrifluoride,
- 5-35% of a hydrocarbon resin as a tackifier, and
- 5-25% of a resin, at least a portion of the resin being selected from the group of styrene-butadiene, polychloroprene, polyvinyl chloride, acrylic, epoxy, urethane, nitrocellulose, and styrene.

22. The composition according to claim 21 wherein at least a portion of the hydrocarbon resin is selected from the group of olefin, rosin ester and terpene.

23. A composition for use as a blowing agent in the manufacture of resin foams, the composition comprising approximately, by total weight of the composition:

50-70% polyether triol;

5 20-40% of one or more of toluene diisocyanate and toluene diisocyanurate;

0-5% catalyst;

0-5% surfactant;

0-10% water; and,

10 2-15% of one or more of: 1-bromopropane; chlorobromomethane; 1,2-dichloro-1,1,1-trifluoroethane.

24. The composition according to claim 23 wherein: the polyether triol is present in the amount 60-65%;

5 the one or more of toluene diisocyanate and toluene diisocyanurate is present in the amount of 30-33%;

the water is present in the amount of 1-2%;

the catalyst is present in the amount of 0.09-2%;

10 the surfactant is present in the amount of 0.3-1.5%; and,

the one or more of 1-bromopropane and chlorobromomethane is present in the amount of 2.4-6.1%.

25. A cleaning composition having generally zero volatile organic compounds (VOCs), the composition consisting essentially of one or more of the zero-VOC solvents selected from the group consisting of:

5 chlorobromomethane;

1-bromopropane;

n-alkane (C12-C18);  
t-butyl acetate;  
perchloroethylene;  
10 benzotrifluoride;  
parachlorobenzotrifluoride;  
acetone;  
1,2-dichloro-1,1,2-trifluoroethane;  
dimethoxymethane;  
15 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-  
butane;  
2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-  
heptafluoropropane;  
1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane; and,  
20 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-  
heptafluoropropane.

26. The cleaning composition of claim 25 wherein the one or more solvents, expressed in terms of total volume of the composition, is selected from the group consisting of:

- 5 (1) 10-90% benzotrifluoride and 10-90% of one or more of the solvents:  
(a) 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxybutane;  
(b) 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane;  
10 (c) 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane;  
(d) 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane;  
15 (e) perchloroethylene;  
(f) 1-bromopropane;  
(g) acetone;  
(h) n-alkane (C12-C16);  
(i) t-butyl acetate (C12-C16); and,

- 20 (j) parachlorobenzotrifluoride;
- (2) 5-20% benzotrifluoride and 80-95% 1-bromopropane;
- (3) 10-90% acetone and 10-90% n-alkane (C12-C18);
- (4) 10-90% 1-bromopropane and 10-90% of one or more
- 25 of:
- (a) chlorobromomethane; and,
- (b) n-alkane (C12-C18);
- (5) 10-90% parachlorobenzotrifluoride and 10-90% of one or more of:
- 30 (a) 1-bromopropane;
- (b) chlorobromomethane;
- (c) t-butyl acetate; and,
- (d) n-alkane (C12-C18);
- (6) 10-90% 1,2-dichloro-1,1,1-trifluoroethane and
- 35 10-90% of one or more of:
- 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane;
- 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane;
- 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane;
- 40 and,
- 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane;
- 1-bromopropane
- acetone;
- 45 benzotrifluoride; and,
- methyl acetate.

09022779 021298

**Abstract**

Environmentally-safer resin-solvent compositions are provided which are generally free of volatile organic compounds (VOCs). The solvent and resin-solvent compositions may replace high-VOC hydrocarbon solvents for use in inks, coatings, adhesives and the like. These novel compositions are negligibly reactive with hydroxyl radicals and therefore are able to reach higher into the atmosphere before decomposing.

0902279 021298

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am an original, first, and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

ZERO VOLATILE ORGANIC COMPOUND COMPOSITIONS BASED UPON ORGANIC SOLVENTS WHICH ARE NEGLIGIBLY REACTIVE WITH HYDROXYL RADICAL AND DO NOT CONTRIBUTE APPRECIABLY TO THE FORMATION OF GROUND BASED OZONE

the specification of which is being filed with the U.S. Patent and Trademark Office herewith.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37 Code of Federal Regulations § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

"Express Mail" Mailing Label Number EM09833572645

Date of Deposit February 12, 1998

I hereby certify that this paper (1) is being deposited with the United States Postal Service "Express Mail" Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Not Applicable.

Ben Trella

INVENTOR

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

**ZERO VOLATILE ORGANIC COMPOUND COMPOSITIONS BASED UPON  
ORGANIC SOLVENTS WHICH ARE NEGLIGIBLY REACTIVE WITH  
HYDROXYL RADICAL AND DO NOT CONTRIBUTE APPRECIABLY TO  
THE FORMATION OF GROUND BASED OZONE**

Serial Number 60/053,073

Filed July 18, 1997

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Not applicable.

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Thomas E. Beall, Jr., Reg. No. 22,410  
Daniel G. Blackhurst, Reg. No. 24,039  
A. John Demarco, Reg. No. 40,586  
Joseph D. Dreher, Reg. No. 37,123  
Christopher B. Fagan, Reg. No. 22,987  
Jeffrey M. Ketchum, Reg. No. 31,174  
Richard M. Klein, Reg. No. 33,000  
Thomas E. Kocovsky, Jr., Reg. No. 28,383  
Sandra M. Koenig, Reg. No. 33,722  
Petar Kraguljac, Reg. No. 38,520  
Scott A. McCollister, Reg. No. 33,961

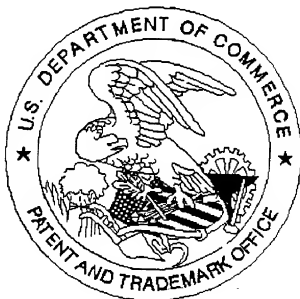
James W. McKee, Reg. No. 26,482  
John R. Mattingly, Reg. No. 30,293  
Richard J. Minnich, Reg. No. 24,175  
Jay F. Moldovanyi, Reg. No. 29,678  
Philip J. Moy, Reg. No. 31,280  
Timothy E. Nauman, Reg. No. 32,283  
Sue Ellen Phillips, Reg. No. 32,046  
Patrick R. Roche, Reg. No. 29,580  
Albert P. Sharpe, III, Reg. No. 19,879  
Mark S. Svat, Reg. No. 34,261

0002279-024200



# United States Patent & Trademark Office

Office of Initial Patent Examination -- Scanning Division



Application deficiencies found during scanning:

1. Application papers are not suitable for scanning and are not in compliance with 37 CFR 1.52 because:
  - ☐ All sheets must be the same size and either A4 (21 cm x 29.7 cm) or 8-1/2" x 11". Pages \_\_\_\_\_ do not meet these requirements.
  - ☐ Papers are not flexible, strong, smooth, non-shiny, durable, and white.
  - ☐ Papers are not typewritten or mechanically printed in permanent ink on one side.
  - ☐ Papers contain improper margins. Each sheet must have a left margin of at least 2.5 cm (1") and top, bottom and right margins of at least 2.0 cm (3/4").
  - ☐ Papers contain hand lettering.
2. Drawings are not in compliance and were not scanned because:
  - ☐ The drawings or copy of drawings are not suitable for electronic reproduction.
  - ☐ All drawings sheets are not the same size. Pages must be either A4 (21 cm x 29.7 cm) or 8-1/2" x 11".
  - ☐ Each sheet must include a top and left margin of at least 2.5 cm (1"), a right margin of at least 1.5 cm (9/16") and a bottom margin of at least 1.0 cm (3/8").
3. Page(s) \_\_\_\_\_ are not of sufficient clarity, contrast and quality for electronic reproduction.
4. Page(s) \_\_\_\_\_ are missing.
5. OTHER NO DRAWING(S)